METHOD AND APPARATUS FOR DETERMINING A DESIRED TRAJECTORY FOR A VEHICLE

PRIORITY CLAIM

[0001] This patent application claims priority to German Patent Application No. 10 2015 217 891.9, filed 17 Sep. 2015, the disclosure of which is incorporated herein by reference in its entirety.

SUMMARY

[0002] Illustrative embodiments provide a method and apparatus for determining a target trajectory or a reference trajectory for a vehicle.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] Disclosed embodiments are described in detail below with reference to the drawings.
[0004] FIG. 1 shows certain components for monitoring the target trajectory of a vehicle;
[0005] FIG. 2 shows the difference between collision-prone and collision-free trajectories;
[0006] FIG. 3 graphically shows the degrees of freedom for different cells;
[0007] FIG. 4 shows a target trajectory together with collision-free and collision-prone trajectories;
[0008] FIG. 5 shows the degrees of freedom of the grid cells together with the target trajectory;
[0009] FIG. 6 shows the degrees of freedom of the grid cells following changes of the boundary conditions together with the previous target trajectory and the current target trajectory;
[0010] FIG. 7 shows a disclosed vehicle with a disclosed device; and
[0011] FIG. 8 shows a flow chart of a disclosed method.

DETAILED DESCRIPTION

[0012] DE 60 2005 001 615 T2 describes the determination of a number of maneuvers that a vehicle can perform and by means of which a collision with an obstacle can be avoided.
[0013] DE 10 2012 203 187 A1 discloses the construction of a trajectory of motion or a set of trajectories of motion, wherein the predicted trajectory of motion is continuously monitored during the driving maneuver and is adapted if required owing to a dynamically changing driving situation. If this is not possible, the trajectory of motion is discarded and predicted again.
[0014] DE 10 2013 217 486 A1 describes a search in an occupancy grid for occupied grid cells that bound a free space.
[0015] Upcoming safety systems for vehicles determine the reaction thereof not only using an egocentric situation analysis, but using a cooperative agreement with other road users. In this case the cooperative agreement with other road users means that in conflict situations the respective involved road users identify, decide and implement common resolution strategies to achieve an improved result overall for all road users.
[0016] The cooperative agreement is mainly implemented by a complex system of perception, interpretation, analysis, decision and performance, wherein the actions are distributed to different agents. The cooperative agreement comprises the calculation of a complex maneuver plan while taking into account an existing environment model and a prediction of the behavior of the road users involved.
[0017] Disclosed embodiments better take into account the behavior of the involved road users when determining and/or monitoring a target trajectory for a vehicle than is the case according to the prior art.
[0018] Disclosed embodiments provide a method for automatically determining and/or monitoring a target trajectory for a vehicle, a device, and a vehicle.
[0019] Disclosed embodiments provide a method for automatically determining and/or monitoring a target trajectory for a vehicle is provided. In this case, a target trajectory connects a starting point, which corresponds to the current position of the vehicle during the first or initial determination of the target trajectory, to a safe target point. The target trajectory practically predetermines a path for the vehicle on which the vehicle is to move from the starting point to the target point (in particular, automatically). The disclosed method comprises the following operations:
[0020] Determining different (in particular, all drivable) trajectories of the vehicle that connect the starting point to the target point. The determination of the finite set of drivable trajectories of the vehicle practically forms the basis for determining the target trajectory that corresponds to the most suitable trajectory from the set.
[0021] Detecting at least one further target trajectory for each involved road user. In this case, each of the further target trajectories connects the starting point or the current position of the respective road user to a safe target point associated with the respective road user. For this an involved road user means a road user that could potentially collide with the vehicle if the vehicle is moving along one of the determined trajectories. In this case, the detection of the (further) target trajectory of an involved road user can also include the detection of a change of the (further) target trajectory of the involved road user, so that the change of the target trajectory can be taken into account when determining and/or monitoring the target trajectory of the vehicle. The target trajectory of the respective further road user can be transmitted from the respective road user to the vehicle, for example, by Car2Car communications.
[0022] Determining collision-free trajectories from the previously determined set of trajectories. For this a trajectory is considered to be collision-free if the vehicle will not collide with one of the further road users if the vehicle is moving along the trajectory and if at the same time the respective road user is moving on (at least one) target trajectory thereof.
[0023] Determining and/or monitoring the target trajectory of the vehicle depending on the collision-free trajectories of the vehicle. For this, determining and/or monitoring the target trajectory also means that a check is made as to whether a once predetermined or determined target trajectory of the vehicle can be maintained. The target trajectory of the vehicle can be maintained if it is still one of the collision-free trajectories of the vehicle.
[0024] By taking into account the further target trajectories of the involved road users when determining and/or monitoring the target trajectory of the vehicle, determining and/or monitoring the target trajectory of the vehicle is improved. Because changes of the plan of the involved road